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congen., peripyelic, pyeloureterostomy (Rus))

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The stratigraphy of the upper-Vorotishchensk formation in the northwestern Ukrainian area of the Carpathian foothill depression. O. P. Gorkun. *Doklady Akad. Nauk S.S.S.R.* 91, 141-4([illegible]).—The differentiation of the profile in the K-bearing formation of the lower Miocene was studied on the basis of various geol. indices and chem. analyses of the deposits. The layer above the K-bearing formation contains clay carbonates, interdispersed with carbonated sandstone. Below the K-formation, salty clay with breccia containing halitic cement with alternating layers of rock salt are found. This salt consists of 75-80% halite, 3% anhydrite, and 15-20% kieserite and insol. residue. In the salty clay there is 8-15% halite, 4-5% anhydrite, 7-20% dolomite, 4-6% magnesite, and 2-3% R_2O_3. J. S. Joffe

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For extensive introduction of the checkrow method of planting root crops for feed and human consumption. Sel'khozmashina no.4:22-24 Ap '54. (MLRA 7:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut sel'skokhozyaystvennogo mashinostroyeniya. (Root crops)

VOLKOV, Yu.I., inzh.; GAFANOVICH, A.A., kand.tekhn.nauk; GLADKOV, N.G., kand.sel'skokhoz.nauk; ~~GORKUSHA, A.Ye.~~, agr.; ZHITNEV, N.F., inzh.; ZANIN, A.V., kand.tekhn.nauk; ZAUSHITSYN, V.Ye., kand.tekhn.nauk; ZVOLINSKIY, N.P.; ZEL'TSERMAN, I.M., kand.tekhn.nauk; KAIPOV, A.N., kand.tekhn.nauk; KASPAROVA, S.A., kand.sel'skokhoz.nauk; KOLOTUSHKINA, A.P., kand.ekon.nauk; KRUGLYAKOV, A.M., inzh.; KURNIKOV, I.I., inzh.; LAVRENT'YEV, L.N., inzh.; LEBEDEV, B.M., kand.tekhn.nauk; LEVITIN, Yu.I., inzh.; MAKHLIN, Ye.A., inzh.; NIKOLAYEV, G.S., inzh.; POLESHCHENKO, P.V., kand.tekhn.nauk; POLUNOCHEV, I.M., agr.; P'YANKOV, I.P., kand.sel'skokhoz.nauk; RABINOVICH, I.P., kand.tekhn.nauk; SOKOLOV, A.F., kand.sel'skokhoz.nauk; STISHKOVSKIY, A.A., inzh.; TURBIN, B.G., kand.tekhn.nauk; CHABAN, I.V., inzh.; CHAPKEVICH, A.A., kand.tekhn.nauk; CHERNOV, G.G., kand.tekhn.nauk; SHMELEV, B.M., kand. tekhn.nauk; KRASNICHENKO, A.V., inzh., red.; KLETSKIN, M.I., inzh., red.; MOLYUKOV, G.A., inzh., red.; BLAGOSKLONOVA, N.Yu., inzh., red.; UVAROVA, A.F., tekhn.red.

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(Agricultural machinery--Design and construction)

GORKUSHA, P. I.

PA 196T98

USSR/Metals - Steel, Casting, Methods Jul 51

"Risers With Air Pressure in Technology of Steel Casting," P. I. Gorkusha, D. R. Kononov, F. A. Kupriyanov, Engineers, "Bolshevik" Plant, Leningrad

"Litey Proizvod" No 7, pp 10-12

Discusses various types of castings which may be fabricated with application of compressed air in blind risers, prepn of molds and pouring procedure. Yield of sound castings increases to 70-80% sometime 90% compared with 50-55% obtainable with ordinary risers. Conservation of

196T98

USSR/Metals - Steel, Casting, Methods (Contd) Jul 51

liquid metal amounts to 24%. Method is effective also for cast iron and for copper- and aluminum-base alloys.

196T98

Gorkun, Yu. I.

57-8-16/36

AUTHOR Gorkun, Yu.I.

TITLE A Contribution to the Theory of the Fast Polaron.
(K teorii bystrogo polyarona - Russian)

PERIODICAL Zhurnal Tekhn.Fiz., 1957, Vol 27, Nr 8, pp 1764-1769 (U.S.S.R.)

ABSTRACT The author refers to the works of PEKAR; This scientist showed that the polarons and not the zone electrons are the basic current carriers in ion crystals. At present only the theory of the slow polaron is worked out where the dependence of the Ψ-function on the velocity of progressive motion v can be neglected. In a number of phenomena, e.g. in the case of the breakdown of a nonconductor fast polarons, for which the dependence of Ψ on v is essential, can play an important role. Here the calculation results for the wave function of a fast polaron according to the variation method are given. The dependence of the polaron energy on the velocity of its progressive motion is shown. By means of the GIPPEL number the breakdowns of ion-dielectrics are classified from the point of view of polarons. Although in all present theories of the electric breakdowns of ion-dielectrics based on the zone idea the interactions between electron and lattice oscillation are regarded as small excitations this is not correct since this interaction is not small. It is properly regarded in the polaron theory. (3 illustrations, 3 tables and 6 Slavic references).

ASSOCIATION Kiyev Institute for Physics of the Academy of Science of the Ukrainian SSR. (Institut fiziki AN USSR, Kiyev).

[illegible]

[illegible], Yu.I., Cand Phys-Math Sci -- (diss) "Peculiarities of ~~motion~~ of
[illegible]
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GORKUN, Yu.I. [Horkun, IU.I.]

Polaron motion in a strong electric field. Ukr. fiz. zhur. Supplement to 3 no.1:32-39 '58. (MIRA 11:6)

1.Institut fiziki AN URSR.
(Ionic crystals--Electric properties) (Quantum theory)

GORKUN, Yu.I. [Horkun, IU.I.]

Polaron retardation [with summary in English]. Ukr. fiz. zhur. 3 no.3:289-296 My-Je '58. (MIRA 11:10)

1. Institut fiziki AN USSR.
(Ions) (Mathematical physics)

AUTHORS: Gorkun, Yu. I., Tolpygo, K. B. 48-22-4-3/24

TITLE: Polar Theory of the Breakdown of Ionic Dielectrics (Polyar-onnaya teoriya proboya ionnykh dielektrikov)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, 1958, Vol. 22, Nr 4, pp. 377-382 (USSR)

ABSTRACT: The theory of breakdown in ionic crystals must be based upon polaron conception of conductivity. All existing theories of breakdown in ionic dielectrics are based upon zonal conceptions (references 1,2). The deficiency of such a conception in the theory of inert electrons was demonstrated in the papers by S. I. Pekar (Ref 3,4). As was shown by him, in ionic crystals the socalled polaron state is most advantageous. In this state the conduction electron with its field polarizes the surrounding dielectric and is located on a discreet level in the potential well, which is formed by the polarized dielectric. In alkali-halide crystals the respective level is by o,15 - o,2 eV lower than the conduction zone, no activation energy being necessary for a transition from the zonal into the polaron sate. Therefore the majority of the conduction electrons must be in polar state (in NaCl, for instance, at

room temperature there is one zonal electron to 10^6 polarons.) As can be seen from reference 3, such a self-coordinated state of the electron and the dielectric is in a position to shift, and by that to transport charge. The theory of an immovable and inert polaron (reference 3) has been developed to the greatest degree of perfection. The authors made it their aim to find the breakdown field from the condition, that the energy obtained by the conduction electron in the field evE (drift speed) increases faster than the energy $\mathcal{E}(v)$ with an increase of the field, E, the latter being lost by the electron per unit time because of the interaction with the lattice. From the energy balance at $E \leqslant E_{pr}$ it is found to be: $E = \frac{\mathcal{E}(v)}{ev}$

If E and v are small the function $\mathcal{E}(v)$ monotonuously increases. The unstable state is reached at the point v_{max}.

$$\left.\frac{dE}{dv}\right|_{v=v_{max}} = 0, \qquad \frac{1}{v} \cdot \frac{d\mathcal{E}}{dv} - \frac{1}{v^2}\mathcal{E}(v) = 0 \qquad (2)$$

At $v > v_{max}$ a further acceleration of the electron takes place disregardin the reduction of the field. Apparently the breakdown occurs at $E = E(v_{max})$. According to reference 2 that point

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corresponds to it, where the gradient in the diagram ln$\mathcal{E}$ of ln v equals unity. From this it appears, that the determination of E_{pr} reduces to the problem of finding $\mathcal{E}$ (v) of the polaron. One of the authors in collaboration with Z. I. Uritskiy (reference 8) computed the function $\mathcal{E}$ (v) for all 6 branches of the crystals NaCl, KCl, KBr, when the polaron state is represented by the Gaussian function

$$\psi_o(r) = \left(\frac{2}{\pi}\right)^{3/4} \alpha^{3/2} e^{-\alpha^2 r^2}; \quad \alpha = \frac{m^* e^2}{3\sqrt{\pi}\,\hbar^2} c; \quad c = \frac{1}{n^2} - \frac{1}{\varepsilon}$$

ε and n^2 denote the statistical and the dielectric high frequency constant m^* denotes the effective mass of zone electron. Analoguous computations were performed by the students of the State University Kiyev Yasinskiy and Nosar. Figure 1 (curve 5) shows the energy values, which the polaron looses in the function of the immeasurable velocity. Diagram 5 (table 1) shows corresponding values u_{max} and E_{pr}. For the latter (fig. 1) the following formula was set up.

$$E_{pr} = 1{,}26 \cdot 10^{-9} \frac{c}{r_o^2} \text{ V cm}^{-1}; \quad r_o = \frac{\hbar^2}{m^* e^2 c}$$

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Table 2 (columns 3 and 4) contain measuring units of v_{max} and E_{pr} of the actual crystals. Due to the increase in size of the polaron radius with velocity (Figure 2) increases with $\mathcal{E}$ (u) more slowly in the case of a deformed polaron than is the case with a fixed polaron. The maximum of $\mathcal{E}$ (u) shifts toward smaller velocities, (figure 1, curve 5). This leads to a better agreement between theory and experiment. For the applicability of the microscopical theory (reference 3) the criterion 1o $r_o \gg a$ is given. The better the microscopical method in the computation of the polaron can by applied, the greater is the agreement between theory and experiment. Still another cause for the higher values of E_{pr} exists. It is not inevitably necessary, that all current carriers possess a maximum velocity v_{max}. It is sufficient, if only a small proportion of the polarons, the random velocity of which coincides with the drift speed, satisfy this condition. More accurate results can be obtained for E_{pr} from a more rigorous computation with the help of kinetic equations. It is obvious, that this theory must be based upon a polaron conception, and that the deformation of the polaron with velocity must be taken into consideration. There are 2 figures, 2 tables, and 8 references, all of which are Soviet.

Polar Theory of the Breakdown of Ionic Dielectrics 48-22-4-3/24

ASSOCIATION: Institut fiziki Akademii nauk USSR (Institute for Physics, AS Ukrainian SSR)

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1. Crystals--Dielectric properties 2. Electrons--Energy 3. Magnetic fields--Applications

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AUTHORS: Gorkun, Yu. I., Tolpygo, K. B.

SOV/20-120-3-14/67

TITLE: The Characteristic Features of the Motion of Rapid Current Carriers in Polar Crystals (Osobennosti dvizheniya bystrykh nositeley toka v polyarnykh kristallakh)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 3, pp. 491 - 494 (USSR)

ABSTRACT: When studying certain phenomena one is bound to direct one's attention also to the motion of fast electrons in solids. This is the case, above all, with electric breakdown, secondary electron emission, and with photoelectron- and autoelectron emission in semiconductors and in dielectrics. The present paper describes the results obtained by investigations of the behavior of polarons (the principal current carriers in ion crystals) in the case of an increase of energy. These investigations were carried out for the limiting case of a very strong bond, if the energy of the polaron is described with great accuracy by the semi-classical theory. The investigation was carried out for not very fast electrons the energy of which can, however, be much

higher than that of thermal electrons. The characteristic features of the methods employed by S.I.Pekar (Ref 1) and N.N. Bogolyubov (Ref 3) are mentioned in short. First of all, an equation is given for the fluctuating motion of a polaron the center of mass of which shifts with a velocity of $\vec{v}$; this is done for the case without exterior field. An expression for the full energy of the system polaron-crystal is written down in consideration of anharmonism. In view of the resonance between the frequency of the enforcing force and the eigenfrequencies during the motion of a fast electron, this motion is - strictly speaking - not steady, but there is an uninterrupted transmission of energy from the polaron to the crystal, i.e. the polaron is slowed down. The here discussed properties of fast current carriers may occur in connection with the emission of photoelectrons and of secondary electrons during the motion of the excited electron towards the surface. The authors investigated only the "selfconsisting" quasi-steady motion of the polaron along the field at a velocity that is constant with respect to time. Several diagrams illustrate the radiation power of the

The Characteristic Features of the Motion of Rapid Current Carriers in Polar Crystals SOV/20-120-3-14/67

oscillations, the dependence of the velocity of the polaron on the field strength, and the mobility of the polaron. Finally, the annihilation of the polaron by the field is discussed. The approximation of strong coupling is, by the way, not applicable in the case of most crystals. There are 4 figures, 2 tables, and 10 references, 9 of which are Soviet.

PRESENTED: December 25, 1957, by A.F.Ioffe, Member, Academy of Sciences, USSR

SUBMITTED: December 25, 1957

1. Electrons--Motion 2. Electorns--Energy 3. Crystals--Properties

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AUTHORS: Gorkun, Yu. I., Tolpygo, K. B.

TITLE: Peculiarities of the Motion of Fast Carriers in Polar Crystals

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1960, Vol. 24, No. 1, pp. 94-100

TEXT: The article under review was read at the Second All-Union Conference on the Physics of Dielectrics (Moscow, November 20-27, 1958). Estimations of mobility and carrier concentration on the basis of the results obtained by S. I. Pekar et al. led to the conclusion that the majority carriers of ion crystals are polarons. First, the difficulties are discussed which are encountered in establishing a theory of the effects of polarons. For the development of a consistent theory it is necessary to have a knowledge of the properties of polarons at high velocities and of the motion of polarons. These may be studied by means of a method devised by Bogolyubov and Tyablikov. However, this method contains improper integrals, and in zeroth approximation it corresponds

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to the semiclassical theory of polarons in which the motion of electrons is described in a quantum-mechanical manner, the motion of lattice ions, however, in a classical way. A study of fast polarons makes it necessary to take account of the anharmonic nature of lattice vibrations. Thus, the authors proceeded from Tolpygo's theory (Ref. 3), which describes the dynamics of a crystal lattice consisting of deformed ions. Consideration of the anharmonic nature leads to the occurrence of an additional imaginary term in the resonance denominator of the amplitudes of forced ion oscillations, whereby improper integrals are excluded. It is assumed that the polaron radius is large compared to the lattice constant, that it is possible to calculate in adiabatic approximation, and that the wave function which describes the fluctuation of the electron in the polarization potential well whose center moves with the velocity v, may be represented by the following Schroedinger equation :

$\left[-\frac{\hbar^2}{2m^*}\Delta + U(\vec{r}) - W_0\right]\psi(\vec{r}) = 0$. $U(\vec{r})$ is given by formula (2). This equation is solved by a variational method using the $\psi_{1,2}$ ansatzes which

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are given by (3) and (4). Formula (6) describes the energy lost by a polaron per unit time. Next, some further expressions are derived for different energies, and the course of the functions is diagrammatically shown. The results obtained for the wave function were used to study the dependence of the potential electron energy on the distance along the field direction. Fig. 5 indicates that in the case of uniform motion of a polaron in the field a distortion of the potential well does not lead to a "fallout" of the discrete electron level from the well. V. M. Buymistrov is mentioned in this article. There are 5 figures, 2 tables, and 11 references, 10 of which are Soviet.

ASSOCIATION: Institut fiziki Akademii nauk USSR (Physics Institute of the Academy of Sciences of the UkrSSR)

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9.4300 (1137, 1043, 1143, 1395)

S/181/61/003/001/034/042
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AUTHOR: Gorkun, Yu. I.

TITLE: Effect of current-carrying electrodes upon the change of resistance in a magnetic field

PERIODICAL: Fizika tverdogo tela, v. 3, no. 1, 1961, 236-242

TEXT: One of the best methods of investigating semiconductors is based upon using the effect of the change in the electric resistance of the specimen by placing it into a magnetic field. By means of this method (Ref. 1), the surface properties of germanium were investigated on very thin plates, and it was found that $(\Delta\varrho_H/\varrho_0)_\perp > (\Delta\varrho_H/\varrho_0)_\parallel$ always holds; ($\perp$ and $\parallel$ denote the position of the H-field with respect to the plate). The question arises now to what extent the change of resistance in a magnetic field depends upon the dimensions of the specimen and on the position of the probes; it was the aim of the author to investigate this problem theoretically. A parallelepipedonn whose center is the origin of coordinates (see Fig. 1), is studied; its faces, which are parallel to the

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x=0 plane, are covered by the current-carrying electrodes (hatched). The magnetic field is assumed to be parallel to the z-axis and only so strong that it is possible to calculate still in weak-field approximation. In the presence of the magnetic field, the current density is then given accurately up to terms of the order of H^2 by

$$\mathbf{j} = \sigma_0 \mathbf{E} + R\sigma_0^2 \mathbf{E} \times \mathbf{H} + M\sigma_0 \mathbf{H} \times (\mathbf{H} \times \mathbf{E}), \quad (2)$$

$$\sigma_0 = q(\mu_{1p} p_1 + \mu_{2p} p_2 + \mu_n n), \quad (3)$$

$$R\sigma_0^2 = \frac{a_m q}{c} (\mu_{1p}^2 p_1 + \mu_{2p}^2 p_2 - \mu_n^2 n), \quad (4)$$

$$M\sigma_0 = \frac{b_m q}{c^2} (\mu_{1p}^3 p_1 + \mu_{2p}^3 p_2 + \mu_n^3 n), \quad (5)$$

$$a_m = \frac{3\sqrt{\pi}}{4} \frac{\Gamma\left(m + \frac{3}{2}\right)}{\Gamma^2\left(\frac{m}{2} + 2\right)}, \quad b_m = \frac{9\pi}{16} \frac{\Gamma\left(\frac{3m}{2} + 1\right)}{\Gamma^3\left(\frac{m}{2} + 1\right)} \quad (6)$$

where q is the electron charge; μ_{1p} and μ_{2p} are the mobilities; p_1, p_2 are the concentration of the holes (two kinds); μ_n and n are the electron

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mobility and concentration, respectively. The following investigations are based upon the assumptions that the mean free path of the carriers is proportional to their velocity ($l_c \sim v^m$), that the specimen is homogeneous, that the current passing through them is small, that their magnetic field may be neglected, and that no non-equilibrium carriers exist. Then $\vec{E} = -\mathrm{grad}\,\varphi$, where φ is determined by the Laplace equation. The potentials of the electrodes are $V_1 = \varphi(l,y,z)$ and $V_2 = \varphi(-l,y,z)$. First, the experimentally measurable potential difference $V_{12} = \varphi(1) - \varphi(2)$ of two points (1) and (2) with the coordinates x_1y_1 and x_2y_2 is calculated and one obtains

$$\frac{V_{12}}{V_1 - V_2} = \frac{x_1 - x_2}{2l} + \frac{4}{\pi^2} R\sigma_0 H \sum_{k=0}^{\infty} \frac{(-1)^k}{(2k+1)^2} \frac{\cos\lambda_k x_1\, \mathrm{sh}\,\lambda_k y_1 - \cos\lambda_k x_2\, \mathrm{sh}\,\lambda_k y_2}{\mathrm{ch}\,\lambda_k \varpi} + \frac{16}{\pi^3}(R\sigma_0 H)^2 \sum_{m=1}^{\infty}\sum_{k=0}^{\infty} \frac{(-1)^m\, \mathrm{th}\,\lambda_k \varpi}{(2k+1)[4m^2-(2k+1)^2]} \times \frac{\sin\frac{m\pi}{l}x_1\, \mathrm{ch}\frac{m\pi}{l}y_1 - \sin\frac{m\pi}{l}x_2\, \mathrm{ch}\frac{m\pi}{l}y_2}{\mathrm{sh}\frac{m\pi}{l}\varpi}. \quad (18)$$

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wherefrom for $x_1 = -x_2 = d$ and $y_1 = y_2 = 0$ one obtains

$$V_{12} = -2dE_x^{(0)}\left\{1 - (R\sigma_0 H)^2 \beta_2\left(\frac{l}{w}, \frac{l}{d}\right)\right\}, \tag{24}$$

$$\beta_2(\xi, \eta) = \frac{32}{\pi^3}\eta \sum_{m=1}^{\infty}\sum_{k=0}^{\infty} \frac{(-1)^{m-1}\,\mathrm{th}\,\frac{(2k+1)\pi}{2\xi}\,\sin\frac{m\pi}{\pi}}{(2k+1)\left[4m^2-(2k+1)^2\right]\mathrm{sh}\,\frac{m\pi}{\xi}}. \tag{25}$$

It is seen herefrom that switching in the magnetic field with a given position of the probes decreases the potential difference between them by $\sim H^2$. As the series given for $\beta_1(\xi)$, like that given by (25) for $\beta_2(\xi,\eta)$, converge very slowly, a transformation was carried out, and better convergence was obtained with

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$$\frac{\beta_1(\xi)}{\frac{16}{\pi^3}\xi} = 8\ln 2 - \frac{63}{4} + \frac{\pi^4}{32} + \frac{15}{16}\pi^2 - 4\sum_{k=1}^{\infty}\frac{8k-1}{(2k-1)^4 k (2k+1)^3} -$$

$$-2\sum_{k=1}^{\infty}\frac{1}{(2k+1)^3}\frac{e^{-\frac{(2k-1)\pi}{\xi}}}{\left[1+e^{-\frac{(2k-1)\pi}{\xi}}\right]}, \qquad (35)$$

$$\beta_2(\xi, \eta) = f_1(\xi, \eta) - f_2(\xi, \eta). \qquad (36)$$

Here

$$f_1(\xi, \eta) = \frac{8}{\pi^3}\eta\sum_{m=1}^{\infty}\frac{(-1)^{m-1}}{m}\frac{\sin\frac{m\pi}{\eta}}{\mathrm{sh}\frac{m\pi}{\xi}}\sum_{k=0}^{m-1}\frac{1}{(2k+1)(2m-2k-1)}, \qquad (37)$$

$$f_2(\xi, \eta) = \frac{64}{\pi^3}\eta\sum_{m=1}^{\infty}(-1)^{m-1}\frac{\sin\frac{m\pi}{\eta}}{\mathrm{sh}\frac{m\pi}{\xi}}\sum_{k=0}^{\infty}\times$$

$$\times\frac{1}{(2k+1)[4m^2-(2k+1)^2]}\frac{e^{-\frac{(2k+1)\pi}{\xi}}}{\left[1+e^{-\frac{(2k+1)\pi}{\xi}}\right]} \qquad (38)$$

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$\xi = 1/w$ and $\eta = 1/d$. For the ratio of the relative changes of resistance one obtains

$$\frac{\Delta \bar{\rho}_H/\rho_0}{\left(\frac{\Delta \rho_H}{\rho_0}\right)_\infty} - 1 = Q\left\{1 - \beta_1\left(\frac{l}{w}\right) - \beta_2\left(\frac{l}{w}, \frac{l}{d}\right)\right\}, \qquad (26a)$$

$$Q = \frac{(1 + \nu_p u_p^2 - \nu_n u_n^2)^2}{\frac{b_m}{a_m^2}(1 + \nu_p u_p + \nu_n u_n)(1 + \nu_p u_p^3 + \nu_n u_n^3) - (1 + \nu_p u_p' - \nu_n u_n^2)^2},$$

$$\nu_p = \frac{p_2}{p_1}, \quad \nu_n = \frac{n}{p_1}, \quad u_p = \frac{\mu_{2p}}{\mu_{1p}}, \quad u_n = \frac{\mu_n}{\mu_{1p}}.$$

If the specimen is a thin plate ($t \ll w$), then $(\Delta\bar{\varrho}_H/\varrho_0) = (\Delta\varrho_H/\varrho_0)_\infty$ and $(\Delta\bar{\varrho}_H/\varrho_0)_\perp - (\Delta\bar{\varrho}_H/\varrho_0)_\parallel = (R\sigma_0 H)^2\left\{1 - \beta_1(\frac{1}{m}) - \beta_2(\frac{1}{w}, \frac{1}{d})\right\} > 0$, which means that the above-mentioned inequality is satisfied. With $\bar{\varrho} = V_{12}/d_{12}\bar{j}_x^y$, where $d_{12} = x_1 - x_2$, and $\bar{j}_x^y$ denotes the x-component of current density averaged over the cross section, one obtains

$$\frac{\Delta\rho_H}{\rho_0}-\left(\frac{\Delta\rho_H}{\rho_0}\right)_\infty = R\sigma_0 H a\left(\frac{l}{w},\ \frac{l}{d},\ \frac{l}{b}\right)+$$
$$+(R\sigma_0 H)^2\left\{1-\beta_1\left(\frac{l}{w}\right)-\frac{1}{2}\beta_3\left(\frac{l}{w},\ \frac{l}{2d},\ \frac{l}{b}\right)\right\},$$

$$a(\xi,\ \eta,\ \zeta)=\frac{4}{\pi^3}\eta\sum_{k=0}^{\infty}\frac{(-1)^k}{(2k+1)^2}\frac{\left[\cos\frac{(2k+1)\pi}{\eta}-1\right]\sin\frac{(2k+1)\pi}{2\zeta}}{\mathrm{ch}\,\frac{(2k+1)\pi}{2\xi}};$$

$x_1 = 2d$, $x_2 = 0$, $y_1 = y_2 = b$; $\xi = 1/b$. The author thanks V. Ye. Lashkarev, Academician AS UkrSSR, for suggesting the subject and for a discussion, as well as E. I. Rashba for comments. There are 2 figures and 7 references: 4 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Institut fiziki AN USSR Kiyev (Institute of Physics, AS UkrSSR, Kiyev)

SUBMITTED: July 13, 1960

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S/181/61/003/004/006/030
B102/B214

24.7400 (1043, 1151, 1158)

AUTHOR: Gorkun, Yu. I.

TITLE: Theory of the field effect at low temperatures

PERIODICAL: Fizika tverdogo tela, v. 3, no. 4, 1961, 1061-1065

TEXT: One of the commonest methods of studying the surface properties of semiconductors bases on the field effect, i.e., the change in conductivity on account of the action of an external transverse electric field. From a comparison of the theoretical and experimental curves $Q_s(V_s)$, it is possible to draw conclusions as to the surface states of the semiconductor; Q_s denotes the charge on the "fast" surface states, and V_s the curvature of the corresponding energy bands. With the model of discreet "fast" surface states, a step-like course of $Q_s(V_s)$ results, which, according to experiments of V. I. Lyashenko and V. G. Litovchenko (FTT, in press), must appear in experiments also. The present theories of the field effect are ill-suited for a comparison of theoretical and experimental results. Therefore, the author develops a new theory valid for any temperature. This is done for the following case: The semiconductor fills the semispace $x > 0$ in

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which the potential distribution $\varphi(x)$ holds with $\varphi(\infty)$ equal to zero. The volume charge density is then given by:

$$\rho(x)=q\left[p(x)-n(x)+\frac{N_d}{\delta_1^{-1}e^{\frac{\mu-E_d+q\varphi(x)}{kT}}+1}-\frac{N_a}{\delta_2 e^{\frac{E_a-\mu-q\varphi(x)}{kT}}+1}\right], \quad (1)$$

where the concentration of the free holes and electrons is defined by:

$$p(x)=\int_{-\infty}^{E_v}\frac{g_2(E)\,dE}{e^{\frac{\mu-E+q\varphi(x)}{kT}}+1}, \quad n(x)=\int_{E_c}^{\infty}\frac{g_1(E)\,dE}{e^{\frac{E-\mu-q\varphi(x)}{kT}}+1}, \quad (2)$$

(q - electronic charge, E_v - ceiling of the valence band, E_c - bottom of the conduction band, N_d and E_d - concentration and energy state of the donor levels, N_a and E_a - the same of the acceptor levels, δ_1 and δ_2 - the ratios of the degeneracy multiplicity factors of empty and filled local centers (donors and acceptors, respectively); and

$$\left.\begin{aligned} g_1(E)&=\frac{4\pi}{(2\pi\hbar)^3}(2m_n)^{3/2}(E-E_c)^{1/2},\\ g_2(E)&=\frac{4\pi}{(2\pi\hbar)^3}(2m_p)^{3/2}(E_v-E)^{1/2}\end{aligned}\right\} \quad (3)$$

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m_p and m_n are the effective carrier masses. With this the charge per unit area of the surface is found to be

$$Q(V_s) = \pm\left(\frac{\varepsilon kT}{2\pi q^2 N}\right)^{1/2} qN\left\{\frac{4}{3\sqrt{\pi}}\left(\frac{m_p}{m}\right)^{3/2}\left[F_{3/2}(\varepsilon_v + V_s) - F_{3/2}(\varepsilon_v)\right] + \right.$$
$$+ \frac{4}{3\sqrt{\pi}}\left(\frac{m_n}{m}\right)^{3/2}\left[F_{3/2}(\varepsilon_c - V_s) - F_{3/2}(\varepsilon_c)\right] +$$
$$\left. + \nu_d \ln\left(\frac{\delta_1^{-1} + e^{\varepsilon_d - V_s}}{\delta_1^{-1} + e^{\varepsilon_d}}\right) + \nu_a \ln\left(\frac{\delta_2 + e^{\varepsilon_a + V_s}}{\delta_2 + e^{\varepsilon_a}}\right)\right\}^{1/2}, \quad (7)$$

where the notations

$$F_n(a) = \int_0^\infty \frac{\xi^n d\xi}{e^{a+\xi} + 1}, \quad (8)$$

$$\varepsilon_v = \frac{\mu - E_v}{kT}, \quad \varepsilon_c = \frac{E_c - \mu}{kT}, \quad \varepsilon_d = \frac{E_d - \mu}{kT}, \quad \varepsilon_a = \frac{\mu - E_a}{kT}, \quad (9)$$

are used; the signs $\pm$ hold for $V \gtrless 0$. To obtain a relationship between the applied field strength and the curvature of the band, a comparison is made between the theoretical and experimental values of the change in conductivity as a function of V_s. From:

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$$\Delta\sigma(V_s) = q\mu_p \int_0^\infty \{p(x) - p_0 + b[n(x) - n_0]\}\, dx, \qquad (11)$$

one obtains

$$\Delta\sigma(V_s) = \frac{2}{\sqrt{\pi}} q\mu_p N \times$$

$$\times \int_{V_s}^{0} \frac{\left(\frac{m_p}{m}\right)^{3/2} [F_{1/2}(\varepsilon_v + V) - F_{1/2}(\varepsilon_v)] + b\left(\frac{m_n}{m}\right)^{3/2} [F_{1/2}(\varepsilon_c - V) - F_{1/2}(\varepsilon_c)]}{\frac{4\pi q}{\varepsilon kT} Q(V)} dV, \quad (12)$$

$b = \mu_n/\mu_p$ is the carrier mobility ratio; p_0 and n_0 are the volume concentrations of the carriers at V = 0. Now the experimentally measurable "mobility of the field effect" ($\mu_{эп}$) is briefly studied. It is defined by

$$\mu_{э.п.} = \frac{d\Delta\sigma}{d\Sigma}, \qquad (13),$$

$$\Sigma(V_s) = Q(V_s) + Q_s(V_s), \qquad (14)$$, and

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$$Q_s(V_s) = -\frac{qN_{sd}}{\delta_{s1}^{-1} e^{\frac{\mu - E_{sd}}{kT} + v_s} + 1} - \frac{qN_{sa}}{\delta_{s2} e^{\frac{E_{sa} - \mu}{kT} - v_s} + 1}, \quad (15)$$

N_{sd}, N_{sa}, E_{sd}, and E_{sa} denote the concentrations and energy levels of the donor and acceptor "fast" surface states, respectively. From this one obtains:

$$\mu_{\text{п. п.}} = \mu_p \frac{2}{\sqrt{\pi}} \left\{ \left(\frac{m_p}{m}\right)^{3/2} [F_{1/2}(\varepsilon_v + V_s) - F_{1/2}(\varepsilon_v)] + \right.$$

$$+ b \left(\frac{m_n}{m}\right)^{3/2} [F_{1/2}(\varepsilon_c - V_s) - F_{1/2}(\varepsilon_c)] \times$$

$$\times \left\{ \frac{\rho(V_s)}{qN} + \frac{4\pi q}{\varepsilon kT} \frac{Q(V_s)}{N} \left[\frac{\delta_{s1}^{-1} N_{sd} e^{\frac{\mu - E_{sd}}{kT} + v_s}}{\left(\delta_{s1}^{-1} e^{\frac{\mu - E_{sd}}{kT} + v_s} + 1\right)^2} + \frac{\delta_{s2} N_{sa} e^{\frac{E_{sa} - \mu}{kT} - v_s}}{\left(\delta_{s2} e^{\frac{E_{sa} - \mu}{kT} - v_s} + 1\right)^2} \right] \right\}^{-1}. \quad (16)$$

If $\varepsilon_v + V_s \gg 1$ and $\varepsilon_c - V_s \gg 1$, the following simpler formulas hold:

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$$Q(V_s) = \pm q\left(\frac{\varepsilon kT}{2\pi q^2}\right)^{1/2}\Bigg\{p_0\left(e^{-Y_s}-1\right)+n_0\left(e^{Y_s}-1\right)+$$

$$+N_d\ln\left(\frac{\delta_1^{-1}+e^{\varepsilon_d-Y_s}}{\delta_1^{-1}+e^{\varepsilon_d}}\right)+N_a\ln\left(\frac{\delta_2+e^{\varepsilon_a+Y_s}}{\delta_2+e^{\varepsilon_a}}\right)\Bigg\}^{1/2}.$$

$$\Delta\sigma(V_s) = \pm q\mu_p\left(\frac{\varepsilon kT}{8\pi q^2}\right)^{1/2}\times$$

$$\times\int_{Y_s}\frac{\left[p_0\left(e^{-Y}-1\right)+bn_0\left(e^{Y}-1\right)\right]dV}{\left\{p_0\left(e^{-Y}-1\right)+n_0\left(e^{Y}-1\right)+N_d\ln\left(\frac{\delta_1^{-1}+e^{\varepsilon_d-Y}}{\delta_1^{-1}+e^{\varepsilon_d}}\right)+N_a\ln\left(\frac{\delta_2\cdot}{\delta_2+e^{\varepsilon_a}}\right)\right\}}$$

$$\mu_{\text{a.e.}} = \frac{q\mu_p\left[p_0\left(e^{-Y_s}-1\right)+bn_0\left(e^{Y_s}-1\right)\right]}{\rho(V_s)+\frac{4\pi q^2}{\varepsilon kT}Q(V_s)\left[\frac{\delta_{s1}^{-1}N_{sd}e^{\frac{\mu-E_{sd}}{kT}+Y_s}}{\left(\delta_{s1}^{-1}e^{\frac{\mu-E_{sd}}{kT}+Y_s}+1\right)^2}+\frac{\delta_{s2}N_{sa}e^{\frac{E_{sa}-\mu}{kT}-Y_s}}{\left(\delta_{s2}e^{\frac{E_{sa}-\mu}{kT}-Y_s}+1\right)^2}\right]}. \quad (21)$$

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Professor V. I. Lyashenko and O. V. Snitko are thanked for hints, and K. B. Tolpygo for discussions. There are 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Institut fiziki AN UkrSSR Kiyev (Institute of Physics, AS UkrSSR, Kiyev)

SUBMITTED: June 7, 1960

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S/181/61/003/010/002/036
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24,7600 (1043, 1137, 1164)

AUTHORS: Gorkun, Yu. I., and Tolpygo, K. B.

TITLE: Theory of transfer effects in p-type Ge-like semiconductors

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 2903-2912

TEXT: The general mathematical procedure (Ref. 7: K. B. Tolpygo. Tr. IFAN USSR, vyp. 3, 52, 1952) to render galvanoelectric, thermoelectric, and magnetic effects as functions of the $\vec{E}$ and $\vec{H}$ fields of the temperature gradients, and of the carrier concentrations is applied to the Hall effects and the magnetic resistivity of p-type semiconductors. The set of kinetic equations is solved for semiconductors with spherical bands that are in contact at k = 0 (such as p-type Ge, but without taking band corrugation into account). General expressions are derived for the current density $\vec{J}$ and the heat flow $\vec{Q}$ from which the role of band-to-band transitions under the action of a magnetic field may be estimated. Part of the fundamental relations are taken from Ref. 7. The consistent set of Boltzmann equations which are represented as $\vec{\chi}_\alpha + a_\alpha(\vec{H}\times\vec{\chi}_\alpha) - b_\beta\vec{\chi}_\beta = \vec{\chi}_{o\alpha}$, $\alpha \neq \beta$, is solved for light and heavy holes. H. Ehrenreich and A. Overhauser (Phys. Rev. 104, 649, 1956)

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have solved this set for $H = 0$. Here, it is treated for $H \neq 0$ and $\alpha, \beta = 1, 2$. For the current density $\mathbf{j}$ the calculations are given in detail.

$$\begin{aligned}\mathbf{j} = \mathbf{j}_n + \mathbf{j}_{1p} + \mathbf{j}_{2p} = \sigma_0 \mathbf{E} + \mathcal{R}\mathbf{E}\times\mathbf{H} + M\mathbf{H}\times(\mathbf{H}\times\mathbf{E}) + \\ + q\left(D_n\nabla N - D_{1p}\nabla P_1 - D_{2p}\nabla P_2\right) + \frac{kT}{q}\left(R_n\nabla N - R_{1p}\nabla P_1 - R_{2p}\nabla P_2\right)\times\mathbf{H} + \\ + \frac{kT}{q}\mathbf{H}\times[\mathbf{H}\times(M_n\nabla N - M_{1p}\nabla P_1 - M_{2p}\nabla P_2)] - U_1\nabla\ln T - \\ - U_2\nabla\ln T\times\mathbf{H} - U_3\mathbf{H}\times(H\times\nabla\ln T),\end{aligned} \qquad (27)$$

with

$$\left.\begin{aligned} &\mu_n = \frac{4\pi}{3}\frac{q}{kT}K_1^{(i)}, \quad \mu_{1p} = \frac{4\pi}{3}\frac{q}{kT}(J_1^{(i)} + L_1^{(i)}), \quad \mu_{2p} = \frac{4\pi}{3}\frac{q}{kT}(L_1^{(i)} + J_1^{(i)}), \\ &D_n = \frac{kT}{q}\mu_n, \quad D_{1p} = \frac{kT}{q}\mu_{1p}, \quad D_{2p} = \frac{kT}{q}\mu_{2p}, \\ &R_n = \frac{4\pi}{3}\frac{q^2}{kT}K_2^{(i)}, \quad R_{1p} = \frac{4\pi}{3}\frac{q^2}{kT}(J_2^{(i)} + L_2^{(i)}), \quad R_{2p} = \frac{4\pi}{3}\frac{q^2}{kT}(L_2^{(i)} + J_2^{(i)}), \\ &M_n = \frac{4\pi}{3}\frac{q^3}{kT}K_3^{(i)}, \quad M_{1p} = \frac{4\pi}{3}\frac{q^3}{kT}(J_3^{(i)} + L_3^{(i)}), \quad M_{2p} = \frac{4\pi}{3}\frac{q^3}{kT}(L_3^{(i)} + J_3^{(i)}), \\ &\sigma_0 = q(\mu_n N + \mu_{1p}P_1 + \mu_{2p}P_2), \quad \mathcal{R} = R_n N + R_{1p}P_1 + R_{2p}P_2, \\ &M = M_n N + M_{1p}P_1 + M_{2p}P_2,\end{aligned}\right\} \qquad (28)$$

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$$U_r = q\frac{4\pi}{3}\left\{\left(\frac{3}{2}K_r^{(1)} - \frac{m_n}{2kT}K_r^{(0)}\right)N - \left(\frac{3}{2}J_r^{(1)} - \frac{m_{1p}}{2kT}J_r^{(0)} + \frac{3}{2}L_r^{(1)} - \frac{m_{1p}}{2kT}L_r^{(0)}\right)P_1 - \left(\frac{3}{2}J_{r+1}^{(1)} - \frac{m_{2p}}{2kT}J_{r+1}^{(0)} + \frac{3}{2}L_{r+1}^{(1)} - \frac{m_{2p}}{2kT}L_{r+1}^{(0)}\right)P_2\right\}. \quad (28)$$

is obtained. For the heat flow, procedure and results are analogous. Hall effect and resistivity change in a homogeneous semiconductor in a magnetic field are considered as examples to demonstrate the application of the general formula which holds for any $\vec{H}$ and may be applied to any transfer process. In order to simplify calculations it is assumed that $\nabla T = 0$ and that effects of concentration changes are negligible. Also the special case of the Hall effect in a weak magnetic field and a thin specimen is treated under the assumption that the hole concentration deviates from its equilibrium value. There are 8 references: 4 Soviet and 4 non-Soviet. The four references to English-language publications read as follows: R. K. Willardson et al. Phys. Rev., 96, 1512, 1954; J. N. Zemel a. R. L. Petritz. Phys. Rev., 110, 1263, 1958; H. Ehrenreich a. A. Overhauser. Phys. Rev., 104, 331, 1956; H. Ehrenreich a. A. Overhauser. Phys. Rev. 104, 649, 1956.

X

Card 3/4

29680
S/181/61/003/010/002/036
B102/B108

Theory of transfer effects in...

ASSOCIATION: Institut poluprovodnikov AN USSR Kiyev (Institute of Semiconductors AS UkrSSR, Kiyev)

SUBMITTED: March 11, 1961

X

Card 4/4

27964
S/185/61/006/004/007/015
D274/D303

24,7700 (1043, 1138, 1137)

AUTHOR: Gorkun, Yu.I.

TITLE: On the theory of galvanomagnetic surface-effects in semiconductors

PERIODICAL: Ukrayins'kyy fizychnyy zhurnal, v. 6, no. 4, 1961, 497-504

TEXT: The Boltzmann equation is solved in the approximation of a weak magnetic field. A theory of conductivity in semiconductors which takes into account scattering of carriers by the surface as well as zone bending, was formulated by J.R. Schrieffer (Ref. 1: Phys. Rev., 97, 641, 1955). In later works, formulas were derived (for the conductivity of thin plates) which contained the parameter w, representing the probability of mirror reflection of the carriers by the surface. The parameter w is of considerable importance, as it expresses the effect of surface structure on the various phenomena. In earlier works which proceeded from the field effect, the

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S/185/61/006/004/007/015
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On the theory of galvanomagnetic...

charge of the surface levels and the parameter w could not be uniquely determined. For this, further experimental and theoretical data are required. Hence the importance of computing galvanomagnetic effects, making allowance for partly diffuse scattering of carriers by the surface. To a specimen which has the form of an infinitely long plate of thickness d, an electric, as well as a magnetic field, are applied. The Boltzmann equation for the velocity-distribution f is

$$v_z\left(\frac{\partial f_1}{\partial z}\right)_v - \frac{qE_{oz}}{m}\left(\frac{\partial f_1}{\partial v_z}\right)_z + \frac{qH_z}{mc}\left(v_x \frac{\partial f_1}{\partial v_y} - v_y \frac{\partial f_1}{\partial v_x}\right) + \frac{f_1}{\tau} = -\frac{qvE}{kT} f_o, \quad (1)$$

where

$$f_1 = f - f_o, \quad (2)$$

$$f_o = n_i \left(\frac{m}{2\pi kT}\right)^{3/2} \exp\left(-\frac{mv^2}{2kT} + \frac{q\varphi}{kT}\right), \quad (3)$$

$$E_{oz} = -\frac{d\varphi}{dz}; \quad (4)$$

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τ is the relaxation time, (assumed constant). The magnetic field is weak: $B \ll 1$; f_1 is sought by the method of successive approximations, in the form

$$f_1 = f_1^{(0)} + f_1^{(1)} + f_1^{(2)}, \tag{16}$$

where $f_1^{(k)} \sim B^k$. Only terms in B^2 are retained. Boundary conditions are set up, and the solution of the (transformed) equation (1) is obtained:

$$f_1 = v_x \chi_{nx} + v_y \chi_{ny}; \tag{19}$$

$$\chi_{nx} = -\frac{q\tau_n}{kT} f_{n0} \left[E_x - \left(\frac{\mu_n H}{c}\right)^2 E_x - \frac{\mu_n H}{c} E_y + E_x J_{nx} + \frac{\mu_n H}{c} E_y J_{ny} \right]; \tag{20}$$

$$\chi_{ny} = -\frac{q\tau_n}{kT} f_{n0} \left[E_y + \frac{\mu_n H}{c} E_x + E_y F_n - \frac{\mu_n H}{c} E_x J_{ny} \right]. \tag{21}$$

The mean electron-current is found

$$\bar{j}_{nx}d = q\mu_n n\left[E_x - \left(\frac{\mu_n H}{c}\right)^2 E_x - \frac{\mu_n H}{c} E_y\right]\int_0^d e^{u-u_b}\,dz - $$
$$- q\mu_n n\lambda_n\left\{E_x \int d\nu \int dK e^{-\nu} J_{nx} + \frac{\mu_n H}{c} E_y \int d\nu e^{-\nu} \int dK J_{ny}\right\}. \qquad (27)$$

as well as the Hall coefficient R and the conductivity-change in the magnetic field

$$\frac{\sigma_0 - \sigma}{\sigma_0} = \frac{H^2}{c^2}\left[\frac{\mathfrak{A}}{\sigma_0} - \left(\frac{\mathfrak{B}}{\sigma_0}\right)^2\right] \qquad (34)$$

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(where $\mathfrak{A}$ and $\mathfrak{B}$ are given by expressions). For Ge and Si, it is important to take into account light holes when comparing experimental results and theoretical predictions. From the formulas for R and for $\frac{\sigma_0 - \sigma}{\sigma_0}$ it follows that these formulas can be extended to the case of two types of holes. There are 7 non-Soviet-bloc refer-

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On the theory of galvanomagnetic... S/185/61/006/004/007/015
D274/D303

ences. The 4 most recent references to English-language publications read as follows: J.N. Zemel, Phys. Rev., 112, 762, 1958; R.F. Greene, D.R. Franke, J. Zemel, Phys. Rev., 118, 967, 1960; J.N. Zemel, R.L. Petritz, Phys. Rev., 110, 1263, 1958; F.S. Ham, D.C. Mattis, J. research and developm., 4, 143, 1960.

4

ASSOCIATION: Instytut napivprovidnykiv AN USSR, Kyyiv (Institute for Semiconductors AS UkrSSR, Kiyev)

SUBMITTED: December 19, 1960

Card 5/5

GORKUN, Yu.I. [Horkun, IU.I.]

Theory of the field effect. Ukr. fiz. zhur. 6 no.4:567-570 Jl-Ag '61. (MIRA 14:9)

1. Institut poluprovodnikov AN USSR, g. Kiyev.
(Quantum electrodynamics)

TOLPYGO, K.B. [Tolpyho, K.B.]; GORKUN, Yu.I. [Horkun, IU.I.]

Symposium on semiconductors. Ukr. fiz. zhur. 6 no.5:717 S-O '61.
(MIRA 14:11)

(Semiconductors--Congresses)

LIVYY, G.V., kand. tekhn. nauk; [illegible], [illegible]; [illegible], Ya.P.; [illegible], N.N.; GIL'MAN, B.A.

Utilization of sheep pelts unsuitable for the production of fur in the manufacture of chrome leather for shoe uppers and lining. Kozh.-obuv. prom. 7 no.12:12-14 D '65.

(MIRA 19:2)

YUNGER, S.V.; GORKUNENKO, G.N.

Electric slag welding of low alloy 10GS(3N) steel with a thickness of 50 to 140 mm. Avtom. svar. 17 no.2:66-72 F '64. (MIRA 17:9)

1. Volgogradskiy nauchno-issledovatel'skiy institut tekhnologii mashinostroyeniya.

ACCESSION NR: AP4013084 S/0125/64/000/002/0067/0071

AUTHOR: Yunger, S. V.; Gorkunenko, G. N.

TITLE: Electroslag welding of 16GS(3N) 50-140-mm-thick low-alloy steel

SOURCE: Avtomaticheskaya svarka, no. 2, 1964, 67-71

TOPIC TAGS: welding, electroslag welding, 16GS(3N) steel, low alloy steel, weld metal aging, Sv-10G2 electrode wire, AN-8 flux

ABSTRACT: Results of experiments with a new 16GS(3N) low-alloy steel, intended for equipment and boilers to be used in the petroleum and chemical industries, are reported. The chemical composition of the base and weld metals was as follows:

Metal	Content %					
	C	Mn	Si	S	P	Ti
Base	0.17	1.04	0.51	0.027	0.032	0.017
Weld	0.12	1.18	0.22	0.027	0.026	*

* Was not determined

ACCESSION NR: AP4013084

With Sv-10G2 welding wire and AN-8 flux, the welding rate obtained was higher by 20% when compared to 22K steel. The coarse-grain area in the weld-affected zone has a satisfactory initial toughness at temperatures not lower than -10C. Upon normalization with a high tempering, a satisfactory toughness is ensured at temperatures down to -40C. The same area immediately after welding or after a high tempering has a low resistance to workhardness. Normalization with a subsequent high tempering imparts a better resistance to aging to the weld metal and the coarse-grain weld-affected zone down to a temperature of -10C. Pre-normalization of the base metal does not tend to increase the toughness of the large-grain weld-affected zone area. Orig. art. has: no figures, no formulas, and no tables.

ASSOCIATION: Volgogradskiy nauchno-issledovatel'skiy institut tekhnologii machinostroyeniya (Volgograd Scientific-Research Institute of Machine-Building Technology)

SUBMITTED: 22Apr63 DATE ACQ: 26Feb64 ENCL: 00

SUB CODE: ML NO REF SOV: 005 OTHER: 000

Card 2/2

MAKARA, A.M.; ISKRA, A.S.; YEGOROVA, S.V.; YUNGER, S.V.; GORKUNENKO, G.N.; NIKUYKO, N.A.; ZANDBERG, S.A.; BRONSHTEYN, L.M.

Technology of electric slay welding of petroleum refining and chemical apparatus without normalization. Avtom. svar. 18 no.5:11-16 My '65. (MIRA 18:6)

1. Institut elektrosvarki im. Ye.O. Patona AN UkrSSR (for Makara, Iskra, Yegorova). 2. VPTIkhimnefteapparatury (for Yunger, Gorkunenko, Nikuyko). 3. Volgogradskiy zavod im. Petrova (for Zandberg, Bronshteyn).

GORKUNOV, V.I., inzh.; OGAY, V.A., inzh.; PRIKHOD'KO, V.Ye., inzh.

Determining the minimum length of an excavation block in building stone quarries. Shakht.stroi. 8 no.11:13-15 N '64.

(MIRA 18:1)

1. Gosudarstvennyy vsesoyuznyy proyektnyy institut stroitel'nykh materialov, Alma-Ata.

GORLACH, A.A.

Biotypes of winter wheat based on the length of time required for the ripening of seeds after harvesting. Agrobiologiia no. 3:447-452 My-Je '60. (MIRA 13:12)

1. Belotserkovskaya opytno-selektsionnaya stantsiya. (Wheat)

GORLACH, A. A.

Doc Agr Sci - (diss) "Selection of winter wheat in the forest-steppe zone of the Ukrainian SSR. (From experience in the performance of the Belotserkovskaya Selection Station)." Kiev, 1961. 32 pp; (Ministry of Agriculture Ukrainian SSR, Ukrainian Academy of Agricultural Sciences); 200 copies; price not given; (KL, 6-61 sup, 229)

RASPOPOV, I.V.; LUKASHOV, G.G.; PLISKANOVSKIY, S.T.; ARTYUKHOV, B.N.; TARASOV, D.A.; ARIKHBAYEV, V.V.; Prinimali uchastiye: ZENYUKOV, V.P.; NEMTSOV, N.S.; GODLEVSKIY, A.I.; LEVCHENKO, G.F.; DEGTYAREVA, Z.I.; GORLACH, A.A.; YAKUSHECHKIN, Ye.I.

Intensifying the sintering process by air preheating and by improving the performance of exhaust fans. Stal' 23 no.8: 679-682 Ag '63. (MIRA 16:9)

1. Zhdanovskiy metallurgicheskiy institut i metallurgicheskiy zavod "Azovstal'."

(Sintering)

ZANNES, A.N., inzh.; GORLACH, A.A., inzh.; GLOZMAN, M.I., inzh.;
DEMAKOVA, A.V., kand.tekhn.nauk, dotsent

Temper brittleness of arsenic and chromium rail steel. Stal'
23 no.8:740-742 Ag '63. (MIRA 16:9)

1. Metallurgicheskiy zavod "Azovstal'" i Zhdanovskiy
metallurgicheskiy institut.
(Steel--Brittleness) (Tempering)

Effects of granulation and placement of calcined phosphate on grain yields. T. Litynski, E. Gorlach, and N. Warner (Rocz. Nauk Rol., 1953, 67, A, (3), 71—89).—Calcined phosphate, whether powdered or granulated, when placed in furrows was not as effective as was broadcast material in increasing yields of oats and barley. For cereals calcined phosphate should be applied in powdered form and broadcast as evenly as possible. A. H. C[illegible]

GORLACH, H.

POL.

3359 631.816.2 : 66.022 : 521.926

Lityński T., Jurkowska H., Gorlach E. The Influence of Pulverisation of Magnesium Thermophosphate on Its Effect as Fertilizer.

„O wpływie rozdrobienia termofosfatu magnezowego na jego efekt nawozowy". Przemysł Chemiczny. No. 4, 1954, pp. 187—190, 5 figs., 4 tabs.

The influence of pulverisation of the new Polish magnesium thermophosphate on the growth and crop of plants was investigated by means of pot experiments with Italian Rye-grass (Lolium multiflorum). For the experiments were used: one unground product together with three of products ground each to a different degree: 4900, 1600 and 300 meshes. The degree of pulverisation influenced the assimilation of phosphorus and the crop of rye-grass. The maximum fertilizer effect was obtained at 4900 meshes, the effect at 1600 meshes was almost the same; the effect was much lower at 300 meshes and lowest with the unground product. The experiments showed that the 1600 mesh product is sufficiently ground, i.e. the standards for basic slag can be applied to the new magnesium thermophosphate. Standards of pulverisation are to be established definitively on the basis of field experiments.

GORLACH, E.

3

12115* (Fertilizer Value of a New Polish Magnesium Thermophosphate.) O wartości nawozowej nowego krajowego termofosfatu magnezowego. T. Lityński, H. Jurkowska, and E. Gorlach. *Przemysł chemiczny*, v. 10, no. 3, Mar. 1954, p. 128-129.

Preparation, application, and effects on Italian rye grass. Photographs, tables. 18 ref.

Gorlach, E

631.83:666.942.002.67

6021

Łatyński T., Jurkowska H., Gorlach E. Preliminary Research over the Value of Cement-Dust from Electrofilters as a Potassium Fertilizer.

„Wstępne doświadczenia nad wartością pyłu cementowego z elektrofiltrów jako nawozu potasowego". Cement-Wapno-Gips. No. 3, 1955, pp. 57–62, 5 figs, 8 tabs.

Preliminary experiments were carried out to determine whether it is possible to use as a fertilizer cement dust from electrofilters, containing about 6 per cent of K_2O. The cement dust proved a good source of potassium for rye-grass and sunflower; moreover the presence of certain other components, such as lime, silica and microelements, favourably influences the development and yield of crops. The presence of lime makes it possible to regard cement dust as a potassium-lime fertilizer. The low potassium content strongly suggests that the dust ought to be processed in order to obtain a more concentrated product with greater fertilizing properties.

(1)

AG.

POL

Preliminary experiments on value of cement dust from electrical precipitators as potassium fertilizer. Tadeusz [illegible], Halina Jurkowska, and [illegible] Gerlach. *Cement-Wapno-Gips* 11(20), 57-62(1955).—It is shown in pot expts. that dust recovered from a Cottrell [illegible] of a cement mill is a good K and Ca fertilizer for *Helianthus annuus* (I) and *Lolium* [illegible] (II). The cement dust contained: Al_2O_3 14.23, Fe_2O_3 [illegible] 29.23, MgO 1.30, Na_2O 0.50, K_2O 5.86 [illegible] sol. in water), SiO_2 20.20, SO_3 3.46, and [illegible] 22.40%. The soil, used in expts., was a sandy [illegible] pH (in KCl) 5.41 and with 0.7 mg. K_2O/100 g. of [illegible]. To each pot, contg. 3.5 kg. of soil, were added: [illegible] of N (in the form of NH_4NO_3), 0.8 g. P_2O_5 (in the form of $Ca(H_2PO_4)_2.H_2O$), 0.1 g. MgO (in the form of [illegible] $7H_2O$), 16.5 mg. of borax, 6.75 mg. of [illegible] 4.41 mg. of $CuSO_4.5H_2O$. The pots were [illegible] expts. with distd. water up to 60% of the [illegible] ity of the soil. In each pot were put [illegible] 6 weeks, green I was cut off and weighed [illegible] 1, which did not contain any K fertilizer [illegible] green I was 10.7 g., from pot no. 2, contg. [illegible] an amt. = 0.6 g. K_2O the weight was 45 [illegible] no. 3, contg. cement dust as fertilizer in [illegible] K_2O the weight was 53.2 g. To the same [illegible] I were then added (after first adding 0.9 g. [illegible] 5 weeks the green mass weighed from pot no. [illegible] from pot no. 2 15.6, and from pot no. 3 11 [illegible] higher than from the first [illegible] The amt. of K_2O in the green mass from the first and second vegetation was in pot no. 1 76 and 42, resp., in pot no. 2 [illegible] resp., and in pot no. 3 632 and 371, resp. The results with II were not as striking as with I, the reason being that II does not require a Ca fertilizer.

F. J. [illegible]

GORLACH, G.A.; DYKHANOV, N.N.

New type of synthesis of plegicil. Med.prom. 13 no.4:35-40 Ap '59. (MIRA 12:6)

1. Khimiko-farmatsevticheskiy zavod "Akrikhin".
(PHENOTHIAZINE)

DYKHANOV, N.N.; GORLACH, G.A.; SERGOVSKAYA, V.P.

Improved synthesis of aminoacriquine. Med.prom. 14 no.6:22-26 Je '60. (MIRA 13:6)

1. Khimiko-farmatsevticheskiy zavod "Akrikhin". (QUINACRINE)

DYKHANOV, N.N.; GORLACH, G.A.

Synthesis of the chloral hydrate of 10-(2'-dimethylaminoprophyl)-acridone-9. Med. prom. 15 no.8:8-10 Ag '61. (MIRA 14:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut khimicheskikh reaktivov.

(ACRIDANONE)

GORLACH, IVAN ARTEMOVICH

PHASE I BOOK EXPLOITATION 506

Dokshitskaya, Aleksandra Iosifovna, and Gorlach, Ivan Artemovich

Vyplavka stali dlya fasonnogo lit'ya v elektropechakh (Electric-furnace Melting of Steel for Shaped Castings), Moscow, Mashgiz, 1956. 58 p. (Series: Nauchno-populyarnaya biblioteka rabochego liteyshchika, vyp. 12) 7,000 copies printed.

Ed.: Volpyanskiy, L.M.; Reviewer: Kholodov, A.I., Candidate of Technical Sciences; Tech. Ed.: Dugina, N.A.; Managing Ed. of the Ural-Siberian Branch of Mashgiz: Kaletina, A.V.

PURPOSE: This book is written in popular style for readers without special technical training.

COVERAGE: The authors discuss briefly the structure and operation of electric-arc steel-melting furnaces, as well as the technology of melting steel in basic and acid arc furnaces. There are 4 references, all Soviet.

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TALBLE OF
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Electric-furnace Melting of Steel (Cont.) 506

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Electric-furnace Melting of Steel (Cont.) 506

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8-22-58

SOV/133-59-2-6/26

AUTHORS: Dubrov, N.F., Gorlach, I.A., Keys, N.V. and Zhukov, D.G.

TITLE: An Investigation of the Heterogeneity of a Transformer Steel Ingot (Issledovaniye neodnorodnosti slitka transformatornoy stali)

PERIODICAL: Stal', 1959, Nr 2, pp 117-122 (USSR)

ABSTRACT: The chemical and structural non-uniformity of a 6.2 ton ingot of transformer steel was studied. The method of smelting steel in a 40 ton arc furnace is described in some detail. The chemical composition of the metal in the ladle was %: C 0.04; Si 3.20; Mn 0.10; Ni 0.12; Cu 0.12; S 0.007; P 0.009 and Cr 0.04. The metal was bottom poured into 6.2 ton ingots. The shape and dimensions of the ingot are shown in Fig.1. A longitudinal plate, 20 mm thick was cut out from the middle part of the ingot, from which 60 samples were collected by drilling for chemical analysis as shown in Fig.1. The segregation of longitudinal and transverse cross-sections of carbon, sulphur, phosphorus, aluminium and nitrogen is shown in table 1 and Fig.2. The degree of segregation was as follows:

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An Investigation of the Heterogeneity of a Transformer Steel Ingot

Deviation from mean %	C	S	P	Al	N_2
positive	30	30	20	25	10
negative	5	15	10	5	10

Mean silicon content was 3.10%, maximum 3.23% and minimum 2.95%. No regularity in the distribution of silicon was observed. Mean manganese content was 0.095%, a number of samples taken from the upper part of the ingot contained 0.110% and from the bottom part 0.092%. On the basis of mean values it is concluded that the non-uniformity in the distribution of manganese was insignificant. Mean chromium content was 0.030%; in the upper part of the ingot - 0.035% was the predominant concentration and in the bottom part - 0.025%; maximum 0.041% and minimum 0.041%. Thus the distribution of chromium was found to be very non-uniform. The contents of copper and nickel in all samples was stable, for copper it varied from between 0.10 to 0.11% and for nickel from 0.11 to 0.12%. The quantities and composition of non-metallic inclusions which varied from 0.0172 - 0.0066% are shown in table 2.

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An Investigation of the Heterogeneity of a Transformer Steel Ingot

their appearance in Fig.3. The predominant component of non-metallic inclusions was alumina but considerable quantities of TiO_2, SiO_2 and FeO were also found. The size of the individual inclusions was comparatively small, mainly 5μ only a small proportion was of about 50μ. The macro and microstructure of sections taken from various parts of the ingot is shown in Fig 4, 5 and 6 respectively. It is concluded that a considerable improvement in the heterogenity of transformer steel can be obtained if the contents of carbon, sulphur and aluminium are decreased to 0.02%, 0.003% and traces respectively. The introduction of electromagnetic stirring will also improve

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An Investigation of the Heterogeneity of a Transformer Steel Ingot

the uniformity of steel. There are 2 tables, 6 figures and 5 references of which 4 are Soviet and 1 English.

ASSOCIATION: Ural'skiy Institut Chernykh Metallov i Chelyabinskiy Metallurgicheskiy Zavod (Ural Ferrous Metals Institute and Chelyabinsk Metallurgical Works)

Card 4/4

DOKSHITSKAYA, A.I., kand.tekhn.nauk; GORLACH, I.A., inzh.; MALKIN, I.P., inzh.

Comparing the properties of electrical steel made by scrap remelting and with oxidation. Trudy Ural.politekh.inst. no.75:181-193 '59. (MIRA 13:4)
(Steel--Electrometallurgy) (Steel--Defects)

GORLACH, I.A., inzh.

Effect of the technological process of steel smelting on the tendency of castings to crack. Trudy Ural.politekh.inst. no.75:194-206 '59. (MIRA 13:4)
(Smelting) (Steel--Metallography)

S/133/60/000/007/012/016

AUTHORS: Dubrov, N.F.; Gorlach, I.A.; Lyasko, M.V.

TITLE: The Effect[18] of Copper on Transformer Steel[18]

PERIODICAL: Stal', 1960, No. 7, pp. 645 - 646

TEXT: According to the work of V.S. Mes'kin (Ref. 1) it can be assumed that a maximum copper content of 0.6% has no adverse effect on the electrical and magnetic properties of transformer steel, assuming that this quantity of copper is contained as a solid solution in ferrosilicon. Higher demands led to the conclusion that the permissible copper content of transformer steel must not exceed 0.10%. In order to establish unambiguously the effect of copper on transformer steel, tests were carried out on three types of steel of the following composition:

	Si	C	Mn	P	S	Cr	Cu	N_2
А (A)	4.66	0.04	0.01	0.008	0.002	0.010	0.059	0.0017
Б (B)	4.69	0.02	0.03	0.010	0.006	0.070	0.310	0.0018
В (V)	4.59	0.03	0.04	0.009	0.003	0.030	0.046	0.0050

Steel A and B were melted in a 300 kg induction furnace and steel V in a 500

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kg arc furnaces. From these steels sheets were rolled 0.35 mm thick, which were tempered at 1.120°C in industrial vacuum furnaces (with a residual pressure of 60 mm Hg). From the sheets 30 x 250 mm strips were cut which were tested by the absolute wattmeter method, according to ГОСТ (GOST) 802-50 for specific loss ($P_{10/50}$), and by ballistic method for magnetic induction in weak and medium fields. Magnetic induction was apparently most affected by copper in weak fields (between $B_{0.002}$ and B_1). Specimens of various copper content in medium magnetic fields (B_5 - B_{25}) practically did not show any change in magnetic induction. Copper has an effect on specific losses when the Cu content exceeds 0.3% and this influence is very considerable when the Cu content is above 0.5%. Judging from the tests it can be assumed that the separation of Cu from ferrosilicon starts already when its amount is well below 0.6%. When examining non-metallic inclusions in many samples, on the boundary of the inclusion cores complex iron sulfides and copper sulfides were observed; the latter most probably formed as a result of the $2\ Cu + FeS \rightleftarrows Cu_2S + Fe$ reaction (1). At high temperature (1,120 - 1,150°C) annealing in the vacuum the reaction should proceed to the right as at 1,100°C: $\Delta F^o_{FeS} = 11,930$ cal (2) and $\Delta F^o_{Cu_2S} = 20,070$ cal (3). Consequently, copper separates from the ferrosilicon solution in the form of Cu_2S. Upon the sep-

aration of copper in pure form or in the form of sulfurous compounds, heterogeneous mixtures are formed which deteriorate the electric and magnetic properties of transformer steel. It is advisable, therefore, to keep the maximum copper content below 0.20% in steels which are standardized for magnetic induction and below 0.40% in steels which are standardized for specific losses. When used in fields of 0.008 a.t./cm capacity or less, transformer steels should apparently not contain any copper at all; even a quantity of 0.2% is inadmissible. There are 3 graphs, 2 sets of photographs and 4 references: 2 Soviet and 2 German.

ASSOCIATION: Ural'skiy nauchno-issledovatel'skiy institut chernykh metallov (Ural Scientific Research Institute of Iron and Steel)

S/133/61/000/005/001/009
A033/A133

AUTHORS: Dubrov, N.F.; Gorlach, I.A.; Privalov, S.S.

TITLE: At the Zhdanovskiy metallurgicheskiy institut (Zhdanov Metallurgical Institute). Investigating the smelting process of transformer steel in the electric furnace [in cooperation with the Chelyabinskiy i Verkh-Isetskiy metallurgicheskiy zavod (Chelyabinsk and Verkh-Isetsk Metallurgical Plants)]

PERIODICAL: St...', no. 5, 1961, 403

TEXT: The technological conditions of obtaining transformer steel with a minimum of impurities have been investigated. Adding to the charge up to 6% iron ore and up to 3% lime (of the weight of the metal charge) ensures an Mn-content not exceeding 0.10% and a Cr-content of 0.003%. The reduction of the Mn-content in the metal is accompanied by an increase of the coefficient of chromium distribution between slag and metal. To decrease the C-content to 0.03 - 0.04% it is necessary to blow through the bath with pure oxygen not containing nitrogen and moisture. A rapid reduction of the sulfur content of steel can be achieved by: alloying the metal with silicon at the beginning of the refining period, by the

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presence of liquid foamy slag containing not more than 1.5 - 2.0% FeO in the bath prior to tapping, and by an intensive stirring of the metal with the slag during the pouring of the melt into the ladle. During the silicon-alloying of the melt at the beginning of the refining period, the nitrogen content of the steel does not exceed 0.005 - 0.007% which increases to 0.007 - 0.010% during alloying at the end of this period. The utilization of magnesium-silicon for the final deoxidation contributes to a decrease in the oxygen content by 15 - 20%. [Abstracter's note: Essentially complete translation].

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Effect of managanese on the phase consitution of electrical silicon steels. Fiz. met.i metalloved. 11 no.6:919-922 Je '61.
(MIRA14:6)

1. Ural'skiy nauchno-issledovatel'skiy institut chernykh metallov.
(Steel--Metallography)
(Manganese)